Sustainability Science of Ocean Food Ecosystems



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Contents: What Can Science Do?

- 1. The Types of Science We Need
- 2. The Types of People We Need
- 3. Ecological Aquaculture and The Ecosystem Approach to Aquaculture
- 4. Sustainability Science of Ocean Foods
- 5. The New Social Contracts for Aquaculture





AUGUST 97H-157H 2003

www.economist.com

Schwarzenegger to run

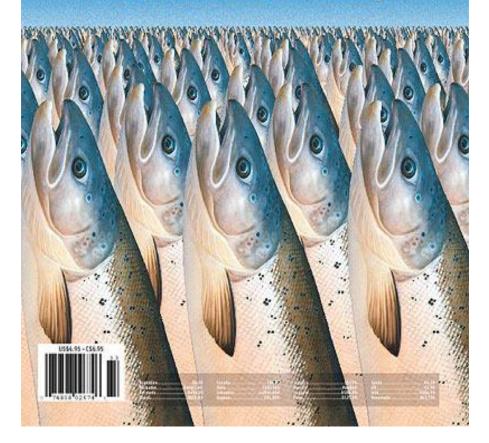
The gay-marriage debate heats up

Terror in Jakarta

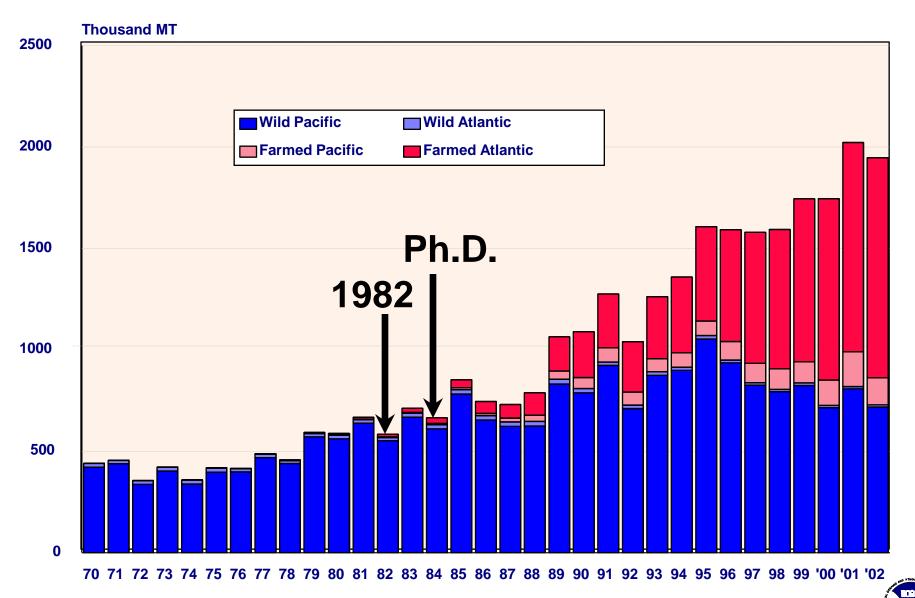
How immigration is changing London

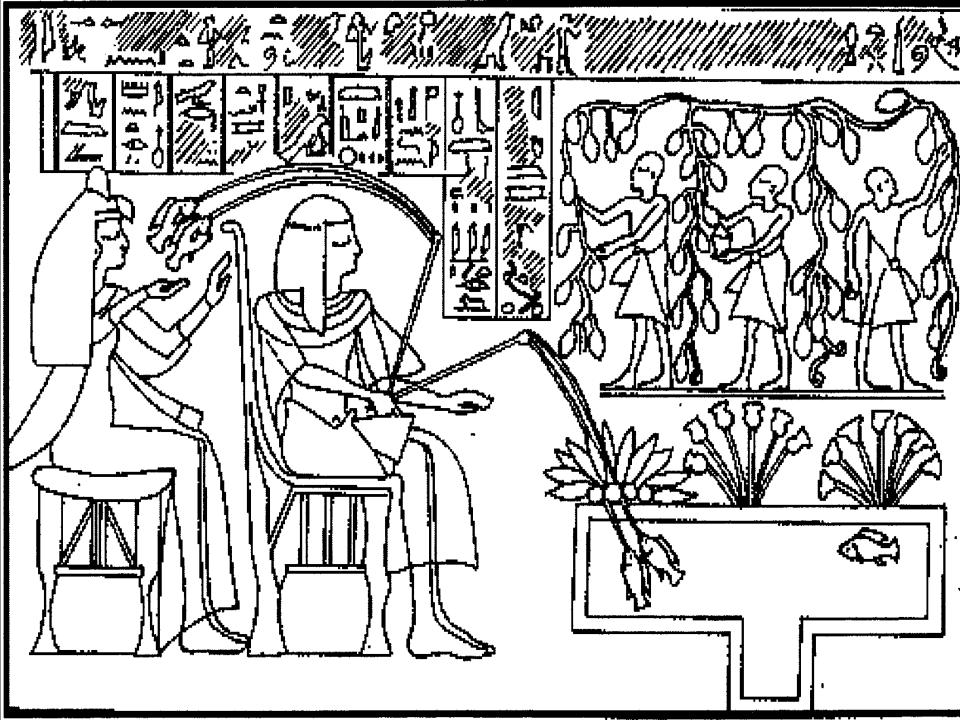
Blue revolution

The promise of fish farming

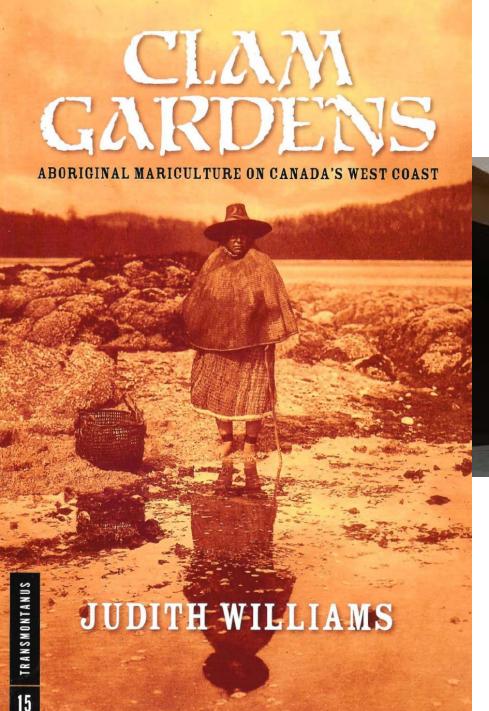


GLOBAL SALMON PRODUCTION, 1970 - 2002











B. Reid "Raven and First Men"

Egypt 4,000 y ago **China 2,300 y ago** Europe 2,100 y ago Bolivia 2,000 y ago Mexico 1,400 y ago Indonesia 1,400 y ago Cambodia 1,000 y ago Hawaii 700 y ago

Costa-Pierce, B.A. 2010. Sustainable ecological aquaculture systems: the need for a new social contract for aquaculture development. Marine Tech. Soc. Jor. 44(3): 1-25.





THE EVOLUTION OF THE BLUE REVOLUTION

BARRY A. COSTA-PIERCE



HAVE WE EVOLVED?

NOT MUCH

MYTH - HALF OF WORLD'S SEAFOOD <u>NOT</u> FROM AQUACULTURE

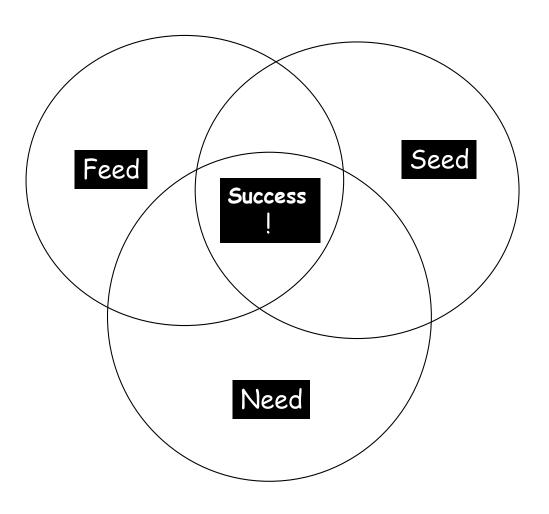
MIGHT ONLY BE 20-25%

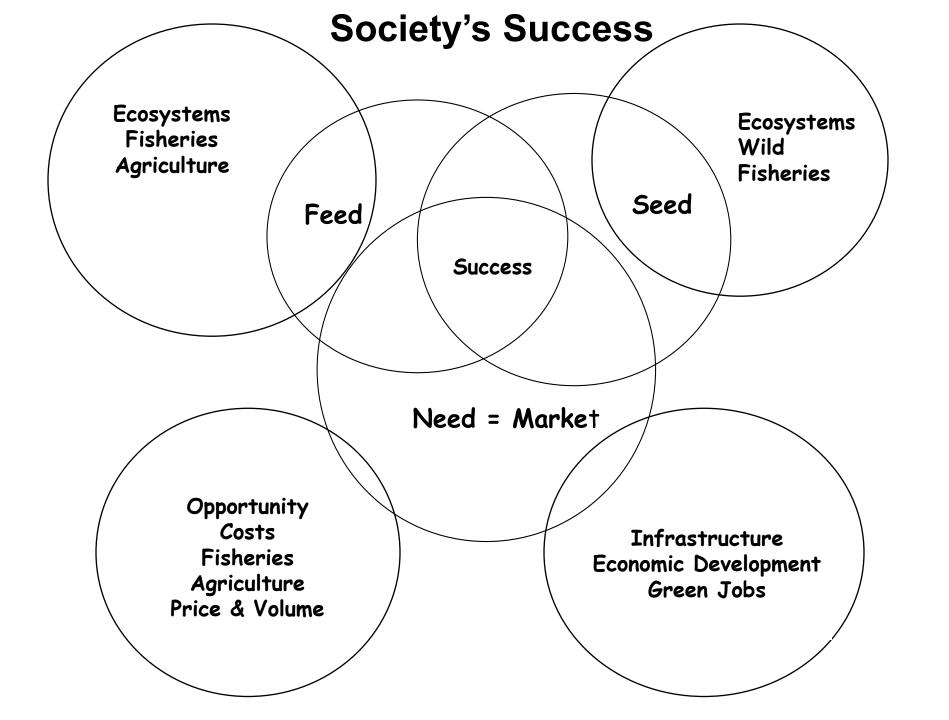
CHINA IS 80%
MOST IS SEAWEEDS, SHELLFISH, CARPS

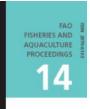
AQUACULTURE DECLINED IN USA, EUROPE,

NOT TAKEN OFF IN AFRICA OR MUCH OF OCEANIA

Aquaculture Business Success







Building an ecosystem approach to aquaculture

FAO/Universitat de les Illes Balears Expert Workshop 7–11 May 2007 Palma de Mallorca, Spain

Food & Agriculture Organization of the United Nations

Ecosystem Approach to Aquaculture



2007 - present





"An Ecosystem Approach to Aquaculture

is a strategy for the

integration of the activity within the wider ecosystem such that

it promotes <u>sustainable development,</u> <u>equity, and resilience</u> of

interlinked social-ecological systems".

Being a strategy, the ecosystem approach to aquaculture it is not what is done, but rather *how it is done*.

The participation of stakeholders is at the base of the strategy.

Sustainability Science of Ocean Foods

www.ecologicalaquaculture.org

The Aquaculture Toolbox to Restore Marine Fisheries, Ecosystems, Habitats and Working Waterfront Communities

Beyond old arguments

artificial divisions

professional balkanization

Conventional approach

Ecosystem approach

Top-down

One objective: production

Sectoral

Farm scale (most common)

Predictive

Scientific knowledge

Prescriptions

Corporate

Participatory

Multiple objectives

Interaction with other sectors

Multiple (nested) scales

Adaptive

Extended knowledge

Incentives

Public / Transparent

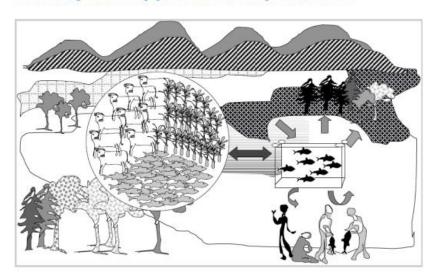
FAO TECHNICAL GUIDELINES FOR RESPONSIBLE FISHERIES

5

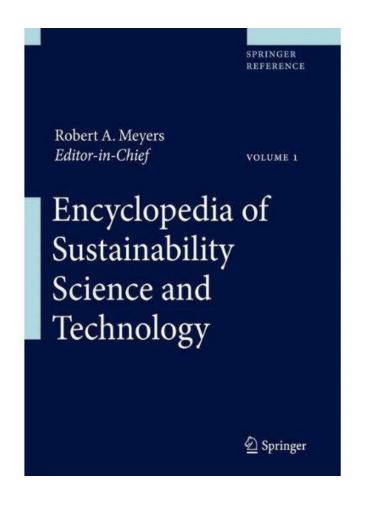
Suppl. 4

AQUACULTURE DEVELOPMENT

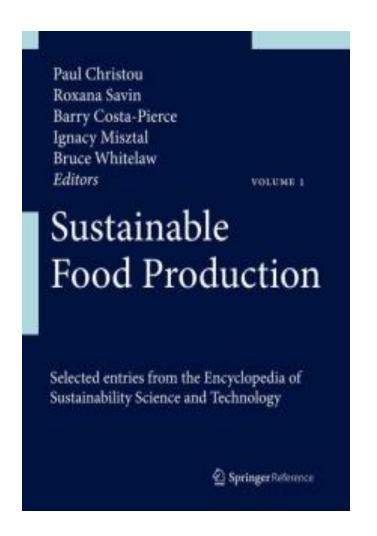
4. Ecosystem approach to aquaculture







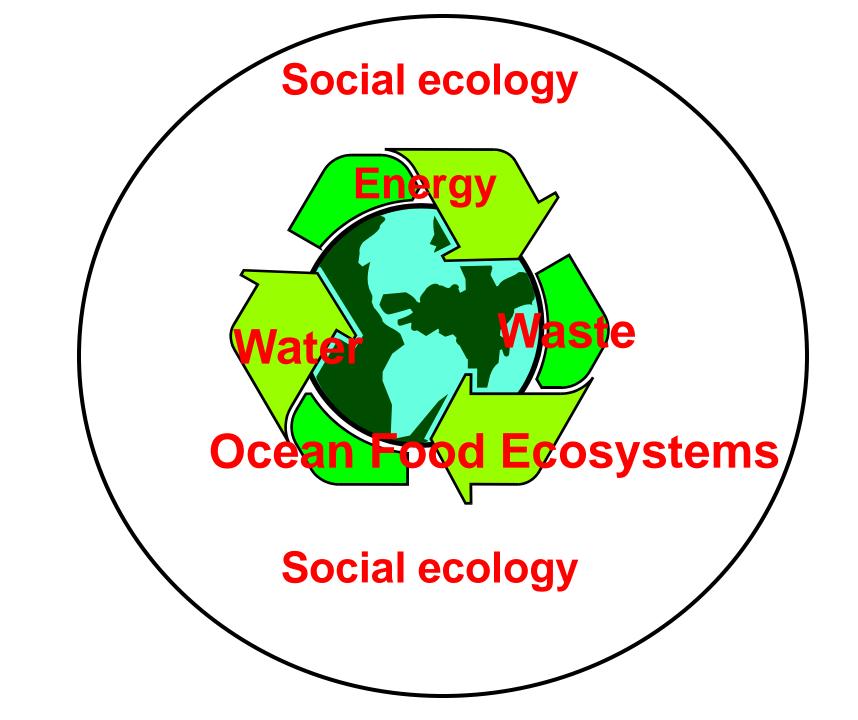
2012: 18 vols., 15,222 pages

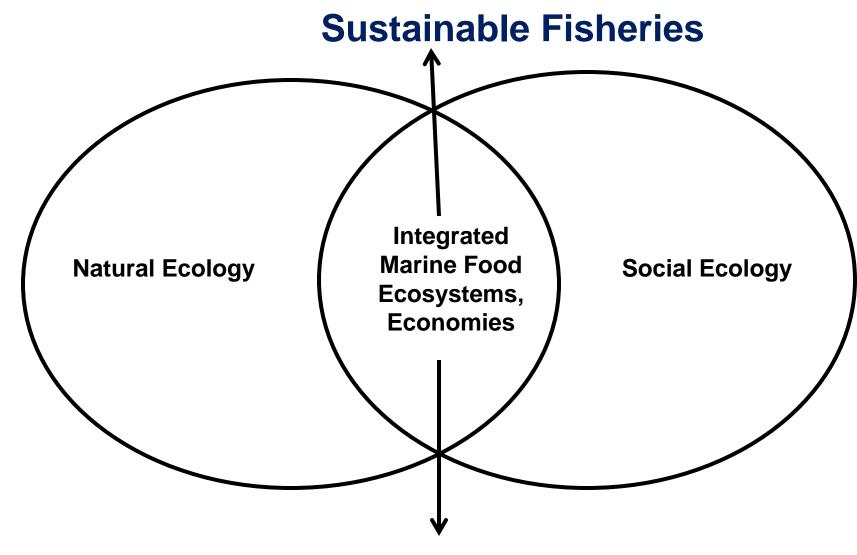


2013: 3 vols., 1,865 pages

Costa-Pierce, B.A. (ed.), Ocean Farming and Sustainable Aquaculture Science and Technology. Encyclopedia of Sustainability Science and Technology.

Springer Reference, N.Y.





Ecological Aquaculture

Sustaining Seafood Supplies

Restore Marine Fisheries
Reduce Bycatch
Expand Use of Underutilized Fish

Increase Aquaculture

Increase Processing Efficiencies

Capture Fisheries
"hunting"
The "Wild"

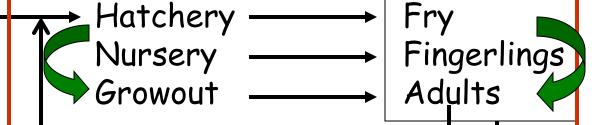
The World Needs Sustainable Ecological Aquaculture AND Sustainable Fisheries Ecosystems

Costa-Pierce (2010)

Broodstock selection

"Open" aquaculture production network

Culture Fisheries "aquaculture"

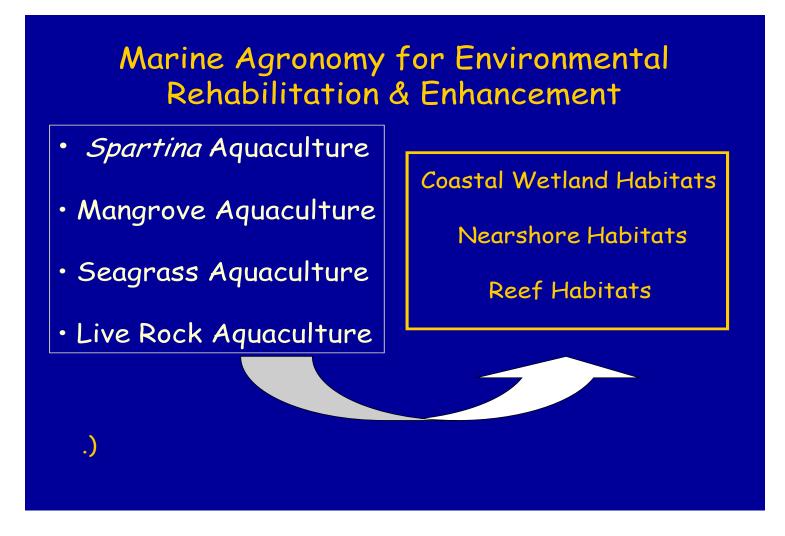


Enhanced Fisheries
"ranching"
"stock enhancement"

Broodstock selection

Closed aquaculture production network

The "aquaculture toolbox" Conservation/Restoration Aquaculture



Costa-Pierce, B.A. and C.J. Bridger. 2002. The role of marine aquaculture facilities as habitats and ecosystems, p. 105-144. In: R. Stickney & J. McVey (Eds.) Responsible Marine Aquaculture. CABI Publishing Co., Wallingford, U.K.



Sustainable Ecological Aquaculture Systems: The Need for a New Social Contract for Aquaculture Development

AUTHOR

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Sea Grant College Program,
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The successful application of new knowledge and breakthrough technologies, which are likely to occur with ever-increasing frequency, will require an entirely new interdisciplinary approach to policy-making: one that oper-

ABSTRACT

Ecohistories of aquaculture suggest that aquaculture is a natural part of human development throughout history and that modern, industrial aquaculture could strengthen its social and ecological roots by articulating its evolution along a sustainability trajectory and by adopting fully the Food and Agriculture Organization (FAO) ecosystems approach to aquaculture (EAA; Soto et al., 2008). The EAA creates a new code for global aquaculture development, combining into one common framework the two most important social—ecological trajectories for global aquaculture—aquaculture for the world's rich and aquaculture for the world's poor. Knowledge of the rich archeology and anthropology of aquaculture connects this FAO code to antiquity, creating a single development pathway for aquaculture throughout human history. Without widespread adoption of an EAA, FAO (2009) projections of aquaculture development over the next 30 years may provide a far too optimistic scenario for its global growth. In this regard, aquaculture approaches the last 20 years have been criticized as legicing addition attention and



FED --- NOT-FED --- NOT FOOD

SHELLFISH SEAWEED

ORNAMMENTALS
RESTORATION
BIOREMEDIATION
ENHANCEMENT
RECREATION



These Species Have a New Social Contract

Convergence last ~10 y that user conflicts in shellfish aquaculture <u>can be resolved</u> due to <u>not only technological advances</u> but also to a growing global science/NGO consensus...that <u>shellfish aquaculture can "fit in"</u> in an environmentally and socially responsible manner in many marine environments, the majority of which are <u>already crowded with existing users (even in the offshore!)</u>





Science and Society Say A Major Global Expansion of Shellfish Aquaculture is Needed and Wanted

World Seafood Congress, Washington, DC October 1-5, 2011 Barry A. Costa-Pierce

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Peterson, P., B. Costa-Pierce, B. Drumbauld, E. Hofmann, H. Kite-Powell, D. Manahan, F. O'Beirn, R. Paine, P. Thompson and R. Whitlatch. **2010.** *Ecosystem Concepts for Sustainable Bivalve Mariculture*. National Research Council, Washington, D.C. 147pp.

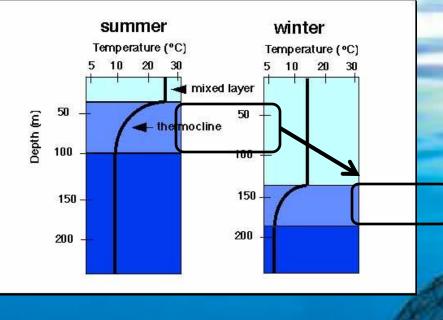
Marine Detrital Food Ecosystems





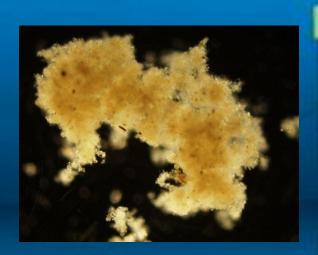
The importance of marine detritus as a primary feedstuff for shellfish in nearshore, offshore, lagoon and bay marine ecosystems has been demonstrated in studies in

Canada (Cranford et al., 2007) Ireland (Ferreira et al., 2007) Maine (Newell et al., 1998) New Hampshire (Langan, 2012) Rhode Island (Byron et al., 2011)



Olazul LLC La Paz, MEXICO

Chlorophyll max
Detrital max
Protein max







Aquaculture conference: To the Next 40 Years of Sustainable Global Aquaculture

3rd -7th November 2013
Palacio de Congresos de Canarias, Las Palmas, Gran Canaria

The conference will be essential for helping assist in a generational change to new leaders for the next science accomplishments needed to double global aquaculture production.

Topics

Aquaculture hatcheries: Science advances and future research needs
Combining marker assisted selection with classic selection programs
Transdisciplinary research needs for the expansion of aquaculture in rural economies
Raw materials and feed ingredients needed for the future of aquaculture
Interactions of aquaculture and the environment

Research institutions and research strategies in aquaculture

